

AMENDMENTS TO THE CLAIMS

Please amend claims 2, 3, 4 and add new claims 8-25, as set forth in the following listing of claims, which will replace all prior versions, and listings, of claims in the present application.

Listing of Claims

1. (Original) A mechanical seal for mounting to a housing containing a rotating shaft, said mechanical seal comprising:

a single rotatable seal ring having a pair of concentric seal faces to form a radially inner seal face and a radially outer seal face, said rotatable seal ring having an axially extending passage formed therein for allowing passage of a barrier fluid therethrough,

first and second stationary seal rings, each having a seal face, wherein the seal face of the first stationary seal ring contacts the radially outer seal face of the rotatable seal ring and the seal face of the second stationary seal ring contacts the radially inner seal face of the rotatable seal ring,

a sleeve adapted to be mounted about the rotating shaft and rotatably coupled thereto and to the rotatable seal ring, said sleeve having a flange portion that is configured for housing at least a portion of the rotatable seal ring, and

a gland for housing at least partially the single rotary seal ring and the first and second stationary seal rings.

2. (Currently Amended) The mechanical seal of claim 1, wherein the rotatable seal ring and the first and second stationary seal rings are configured and arranged to provide for first and second piston areas on a face wall of the rotatable seal ring adjacent an inner surface of the flange that allow the barrier fluid to exert pressure across about 140% of the contact area of the seal face contact areas.

3. (Currently Amended) The mechanical seal of claim 2, wherein the rotatable seal ring and the first and second stationary seal rings are configured and arranged to provide for a third piston area on a non-seal face wall opposite of the rotatable seal ring opposite the radially outer seal face, a fourth piston area on a non-seal face wall opposite the seal face of the first stationary seal

ring, and a fifth piston area on a non-seal face wall opposite the seal face of the second stationary seal ring.

4. (Currently Amended) The mechanical seal of claim ~~4-3~~, wherein the pressure forces exerted on the first and second piston areas are generally offset by the pressure forces exerted on the fourth and fifth piston areas.

5. (Original) The mechanical seal of claim 1, wherein the seal is operable in both positive and negative pressure conditions.

6. (Original) The mechanical seal of claim 1, wherein the seal is operable independent of O-ring size.

7. (Original) The mechanical seal of claim 1, wherein the seal is free of a shuttle element.

8. (New) A mechanical seal for mounting to a housing containing a rotating shaft, said mechanical seal comprising:

a single rotatable seal ring having a pair of concentric seal faces to form a radially inner seal face and a radially outer seal face, said rotatable seal ring having an axially extending passage formed therein for allowing passage of a barrier fluid therethrough,

first and second stationary seal rings, each having a seal face, wherein the seal face of the first stationary seal ring contacts the radially outer seal face of the rotatable seal ring and the seal face of the second stationary seal ring contacts the radially inner seal face of the rotatable seal ring,

a sleeve adapted to be mounted about the rotating shaft and rotatably coupled thereto and to the rotatable seal ring, said sleeve having a flange portion that is configured for housing at least a portion of the rotatable seal ring, and

a gland for housing at least partially the single rotary seal ring and the first and second stationary seal rings,

wherein the rotatable seal ring and the first and second stationary seal rings are configured and arranged to provide for first and second piston areas on a face wall of the rotatable seal ring adjacent an inner surface of the flange that allow the barrier fluid to exert

pressure across a selected portion that is between about 50% and about 140% of the contact area of the seal face contact areas.

9. (New) The mechanical seal of claim 8, wherein the selected area is about 140% of the contact area of the seal face contact areas.

10. (New) The mechanical seal of claim 8, wherein the rotatable seal ring and the first and second stationary seal rings are configured and arranged to provide for a third piston area on a non-seal face wall opposite of the rotatable seal ring opposite the radially outer seal face, a fourth piston area on a non-seal face wall opposite the seal face of the first stationary seal ring, and a fifth piston area on a non-seal face wall opposite the seal face of the second stationary seal ring.

11. (New) The mechanical seal of claim 10, wherein the pressure forces exerted on the first and second piston areas are generally offset by the pressure forces exerted on the fourth and fifth piston areas.

12. (New) The mechanical seal of claim 8, wherein the seal is operable in both positive and negative pressure conditions.

13. (New) The mechanical seal of claim 8, wherein the seal is operable independent of O-ring size.

14. (New) The mechanical seal of claim 8, wherein the seal is free of a shuttle element.

15. (New) A mechanical seal for mounting to a housing containing a rotating shaft, said mechanical seal comprising:

a single rotatable seal ring having a pair of concentric seal faces to form a radially inner seal face and a radially outer seal face, said rotatable seal ring having an axially extending passage formed therein for allowing passage of a barrier fluid therethrough,

first and second stationary seal rings, each having a seal face, wherein the seal face of the first stationary seal ring contacts the radially outer seal face of the rotatable seal ring and the seal

face of the second stationary seal ring contacts the radially inner seal face of the rotatable seal ring,

a sleeve adapted to be mounted about the rotating shaft and rotatably coupled thereto and to the rotatable seal ring, said sleeve having a body portion mounted about the rotating shaft, a flange portion extending from the body portion and defining a recess between the body portion and the flange portion for receiving at least a portion of the rotatable seal ring, a first groove disposed on a radially outer surface of the body portion receiving a first o-ring for contacting a radially inner surface of the rotatable seal ring and a second groove disposed in a radially inner surface of the flange portion receiving a second o-ring for contacting a radially outer surface of the rotatable seal ring, and

a gland for housing at least partially the single rotary seal ring and the first and second stationary seal rings.

16. (New) The mechanical seal of claim 15, wherein the flange portion is separated from a radially extending surface of the rotatable seal ring opposite the radially outer seal face to define a first piston area for allowing process fluid to exert pressure on the radially outer seal face.

17. (New) The mechanical seal of claim 16, wherein the first piston area has an area that is about 70% an area of the radially outer seal face.

18. (New) The mechanical seal of claim 15, wherein the rotatable seal ring includes a radially outward portion defining the radially outer seal face, the radially outward portion comprising a first axially extending outer surface, and an axially extending stepped surface positioned axially and radially inward of the outer surface to define a first axially inwardly facing non-seal face wall formed on a side of the radially outward sealing portion opposite the radially outer seal face.

19. (New) The mechanical seal of claim 18, wherein the second o-ring contacts the axially extending stepped surface.

20. (New) The mechanical seal of claim 18, wherein the axially extending stepped surface terminates in a second axially inwardly facing wall that is spaced radially and axially inwardly from the first axially inwardly facing non-seal face wall.
21. (New) The mechanical seal of claim 18, wherein the rotatable seal ring further comprises a radially inward portion separated from the radially outward portion by the axially extending passage and an intermediate connecting portion for connecting the radially outward portion and the radially inward portion.
22. (New) A mechanical seal for mounting to a housing containing a rotating shaft, said mechanical seal comprising:
- a first seal ring having a pair of concentric seal faces to form a radially inner seal face and a radially outer seal face, said first seal ring having an axially extending passage formed therein for allowing passage of a barrier fluid therethrough for pressure balance control,
- second seal ring having a seal face in contact with the radially outer seal face of the first seal ring,
- third seal ring having a seal face in contact with the radially inner seal face of the first seal ring,
- a sleeve adapted to be mounted about the rotating shaft and rotatably coupled thereto and to at least one of the seal rings, said sleeve having a flange portion that is configured for housing at least a portion of the seal ring, and
- a gland for housing at least partially the seal rings.
23. (New) The mechanical seal of claim 22, wherein the first seal ring is a rotary seal ring.
24. (New) The mechanical seal of claim 22, wherein the second and third seal rings are stationary seal rings.
25. (New) The mechanical seal of claim 22, wherein the barrier fluid fills a space between the flange portion of the sleeve and an axially inwardly facing wall of the first seal ring to provide said pressure balance control.